The Process of Developing and Implementing a Web-Based Solution for Planning and Permitting

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Abstract

Developing a web-based system to support planning and permitting business processes can be a monumental task. This paper offers an example of a group of municipalities in the Silicon Valley region who banned together with the help and encouragement of the private sector to build a Smart Permit Initiative. This paper covers a brief history of this initiative. It also provides a look at the process of developing and implementing a web-based solution. Incorporating GIS into this system is also discussed, with examples of several Southern California agencies used to illustrate opportunities. Lessons learned from the process are also presented. Finally, this paper provides a list of predictions for using the Internet for planning and permitting business process in the future.

Introduction

The Silicon Valley region is 1,500 square miles in area with a population of approximately 2.5 million. It is comprised of 31 city and county jurisdictions encompassing the southern half of the San Francisco Bay Area. It is currently the home to some of the most high tech industries in the world.

As this region emerged from the recession in 1994, there was a common perception by industry that local government was part of the problem rather than part of the solution. A local task force concluded that the region's competitive position was hampered by slow response in its delivery of construction permits by local government. The task force also concluded that permit streamlining which included using technology could transform the way business was being done in this area. A meeting was held in the Fall of 1994 between prominent members of the development community and City Officials. The development community challenged local government in the region to significantly overhaul, streamline and automate the development review process for permits and planning. This group asked for the ability to transact their business over the Internet with the local governments. Local government agreed this was a high priority.

One of the most obvious ways municipalities can transact business over the Internet is by allowing the viewing of and the issuing of permits online. Synergetic Consulting, a software development and consulting firm, has defined two levels of permitting online. The first level of permitting can be considered simple permitting. Simple permits can be classified as permits that do not need a set of plans to be issued a permit. People who obtain simple permits tend to transact a high volume of permits. The second level of

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permitting can be classified as a complex permit. Complex permits usually require a set of plans to be submitted. Also indicative of complex permits is an interaction between the local government and the person seeking a permit for plan and application revision. In either case, a large quantity of travel time can be saved if permitting was done over the Internet.

The purpose of this paper is to provide insight into the planning and implementation process of developing a web-based system for handling planning and permitting business over the internet. Much of this insight was developed over the past five years working with the Smart Permit Initiative. This paper assumes that permitting and planning is already being tracked by the government agency using some sort of database with an application front end. This front end is a program that allows people with no database experience to interface with the database, i.e.; it allows them to enter information into database without learning the commands to enter information. In the case of an Oracle or Microsoft's SQL Server database, the user does not need to know the standard query language (SQL); s/he only needs to know how to use the front-end (typically a Windows-based) program.

This paper is arranged in the following order. In section two an historical background of the Joint Venture: Silicon Valley Network is provided along with a discussion of the different ways some municipalities have implemented web-based planning and permitting. Section three provides examples of how web-based GIS has been adopted for use in Planning Departments. The fourth section explains the process of developing and implementing a web based solution, while the fifth section discusses how to incorporate GIS into web-based planning and permitting. The sixth section reviews some of the lessons learned from developing and implementing web-based solutions for planning and permitting. Finally the paper ends with a summary of the major points and concluding remarks.

Historical Background

In 1994, Silicon Valley saw the development of the Smart Permit Initiative. This initiative was developed to serve as a good example of how Planning, Building and related agencies can participate in and benefit from development of government services on the Internet. This initiative was developed in cooperation with a variety of public and private interests in the greater Silicon Valley, California region under the auspices of first Smart Valley and later Joint Venture: Silicon Valley (JVSV). The Smart Permit Initiative was designed to streamline the permit development process and provide these processes on the Internet to better serve the business community, residents and other interested parties. Two area cities, San Carlos and Sunnyvale, agreed informally to be the initial pilot cities in this effort.

A task force was created to work with local government. The task force determined that the Smart Permit initiative should respond to the following needs: a more efficient permit process to support business time to market pressures, more standardized and easier to understand codes to improve predictability and reliability in the permit process, cities and

industry working together to better resolve permit issues, paperless documentation and storage of permit transactions, a decrease in trips to City Hall for applicants and the ability to determine the status of a permit at any time during the process. The initiative was designed to help coordinate efforts of cities in Santa Clara, San Mateo and Southern Alameda Counties in these areas.

Local agencies were invited to a demonstration in 1995 with a consultant and the City of Palo Alto, which used City building applications. Following the completion of the demonstration, a Smart Permit Steering Committee was formed composed of city managers, corporate facility managers, architect and design engineers, building inspectors, city planners, and technology specialists. This committee had two separate but related primary points of focus for Smart Permit. The first addressed which private software system(s) local agencies would utilize to electronically manage their permitting process. The second addressed online access to this software system.

Representatives from 18 Bay Area cities and San Mateo and Santa Clara Counties participated on a technical subcommittee of the Smart Permit Steering Committee to deal with permitting software systems. In August 1996, the software systems subcommittee produced a "Systems Requirements for Smart Permitting". Interested permitting software vendors reviewed this document and the final version was approved and adopted as the standard by participating cities. The "Systems Requirement" document became the basis for a "Request for Proposal" (RFP) that was mailed to ten permitting software vendors.

Nine out of ten permit software vendors responded to the RFP. The results of the technical subcommittee's review of the vendors' response and individual meetings with those companies resulted in an evaluation report that was released and posted on Smart Valley's website in September 1996. A number of local cities then became involved in a procurement process on an individual and collective basis using the Smart Permit RFP standards.

Two live prototype demonstrations were conducted for over 500 corporate facility managers, engineers, architects, and city officials that September as well. The demos used the Internet and a standard "dial up" connection showcasing how existing technology could be used for permitting. The first involved a virtual conference between the City of San Carlos, a local architect and an audience at the Sunnyvale facility of Lockheed Martin. A CAD drawing representative of a typical permit application was simultaneously reviewed on a real time basis, code violations were discussed, and the drawing marked up and modified, with agreements documented and archived. The second demo was between the City of Sunnyvale and the Lockheed Martin audience. Again, on a real time basis, typical building permit application forms were downloaded, completed, and submitted along with a CAD drawing. The group discovered code violations and resubmitted a modified drawing. Permits were then issued and billed. A vendor provided the Internet-compatible forms.

Following the prototype demonstrations, San Carlos and Sunnyvale officially agreed in the Fall of 1996 to be the region's first Smart Permit pilot cities. The City of Sunnyvale agreed to develop Internet-based software internally as they did not believe the private

vendors could deliver a robust enough Internet product to meet their specific needs in a timely fashion. Each pilot city made a commitment to Smart Valley and later to Joint Venture: Silicon Valley as well as to the other participants in order to receive the benefits of financial support, expert resources and leadership. The pilot cities also brought their particular expertise and perspective to the table.

The Smart Permitting project was officially handed over from Smart Valley to Joint Venture: Silicon Valley and formally became "Smart Permit" in January of 1997 as it became clear through the demos and prototypes that the technology could be applied in this area effectively. With Joint Venture's encouragement and support, the first operating unit of the online permit system was launched in the Fall of 1997 in Sunnyvale using internally developed software. The City of San Carlos led the effort for the vendor-provided software by working with the City of Santa Clara, eight other cities and two counties, collectively known as "BASP" (Bay Area Smart Permit) to send out an RFP. Tidemark Solutions of Seattle, Washington was ultimately selected to develop smart permit software for the BASP software-buying consortium and a general schedule for delivery of the Internet pieces was developed. San Carlos also agreed to be the lead agency to work with Tidemark to help test the Internet software components. In October of 1998, San Carlos demonstrated the first two Internet permit components of the Tidemark Solutions software at the International City/County Management Association Annual Conference in Orlando, Florida.

Milpitas began using an Express Permit system for simple permits using the Internet in January of 1999. That Spring saw a partnership between Joint Venture, Sunnyvale, Mountain View, Microsoft and Carta to develop an integrated e-commerce solution for simple permits. Joint Venture worked with a consultant to develop a feasibility study of a regional Smart GIS mapping system. That year San Carlos also formally activated a number of components of the Tidemark permit software on the Internet (Permit Status, Citizen Comment and later Parcel and Zoning inquiry and eMobile for wireless access to permit data by inspectors in the field). Santa Clara also tested an electronic drawing submittal and collaboration software with Blueline-Online. The Blueline site was also linked to the City's website to help facilitate community review of an actual project going through the City's public hearing process. Sunnyvale activated their e-permits.net system, enabling contractors and property owners to apply for simple permits online. Sunnyvale would later agree to a partnership with GovPartner, an affiliate of Berryman-Henigar to have their program offered to other agencies as PermitPartner. Mountain View would also formally agree to work with GovPartner. San Jose also became a pilot city and IFMA/Joint Venture hosted another update on Smart Permit in San Jose later in the year.

The year 2000 saw San Jose debut online permit processing for high-volume simple permits. Santa Clara also began initial testing of the Tidemark Internet product and testing online plan submission using the Buzzsaw.com project website. Sunnyvale and Mountain View continued to expand their work with GovPartner on the PermitPartner program.

Examples of Applied Web-Based GIS for Planning

Similar to the initiatives to improve the efficiency of the permitting process, Psomas has worked with several agencies in Southern California to apply web-based GIS to enhance many planning business processes and improve customer service. In following several examples of the application of web-based GIS capabilities to specific planning needs are presented.

City of Fontana

Goals

The City of Fontana has been working to develop GIS applications to leverage existing GIS data and improve public service. Specifically, the City wanted to integrate planning and development information within an automated application that would provide online, parcel specific planning information. With the high level of land development in the city, Planning Division staff believed automation could save a significant amount of time researching information and preparing zoning notification letters. With this vision in mind, the Planning Division initiated the development of a GIS application that would integrate planning and property information to increase staff efficiency, provide improved customer service, and meet the workload challenges of the development boom.

Solution

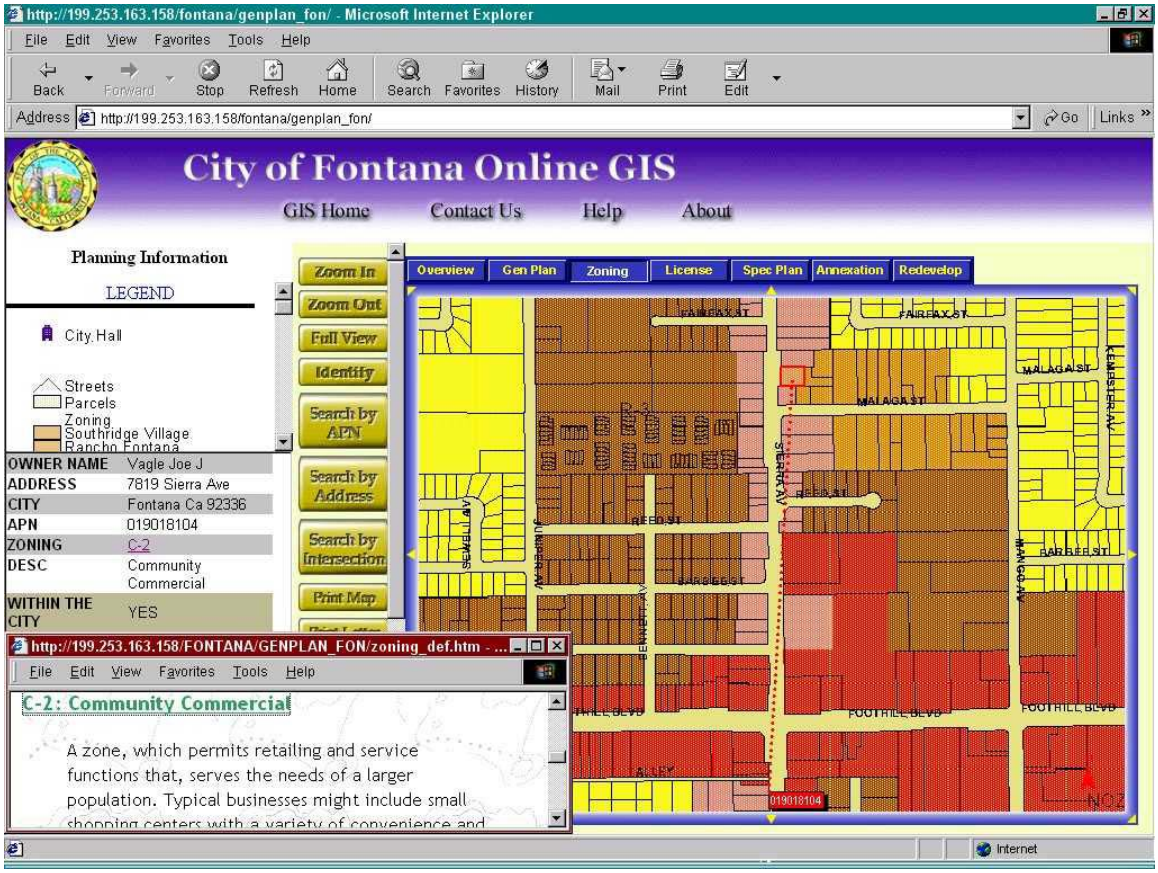
Working with Psomas the City developed and implemented a suite of web-based GIS tools to address the Planning Division's needs. Planning staff worked with Psomas to document existing work processes and identify opportunities to automate the division's standard activities

Specific activities targeted for automation included:

- Property information lookup
- Planning information research
- Zoning notification letters
- ABC license management

Based on the identified needs and the Planning Division's business processes, the project team recommended the development of an Intranet application that integrates the City's parcel database with various planning layers. Using ESRI's Map Objects IMS, the application is accessible via the City Intranet using a web browser and provides an easy-to-use suite of tools addressing each of the targeted activities.

A user simply starts his/her browser and enters an address or parcel number to identify property specific planning information. Within seconds, a map is displayed showing the property in relation to zoning, general plan land use, redevelopment areas, annexations, or specific plan areas. Land use designations are hyperlinked, providing instant access to detailed land use descriptions and the City's Zoning Code.



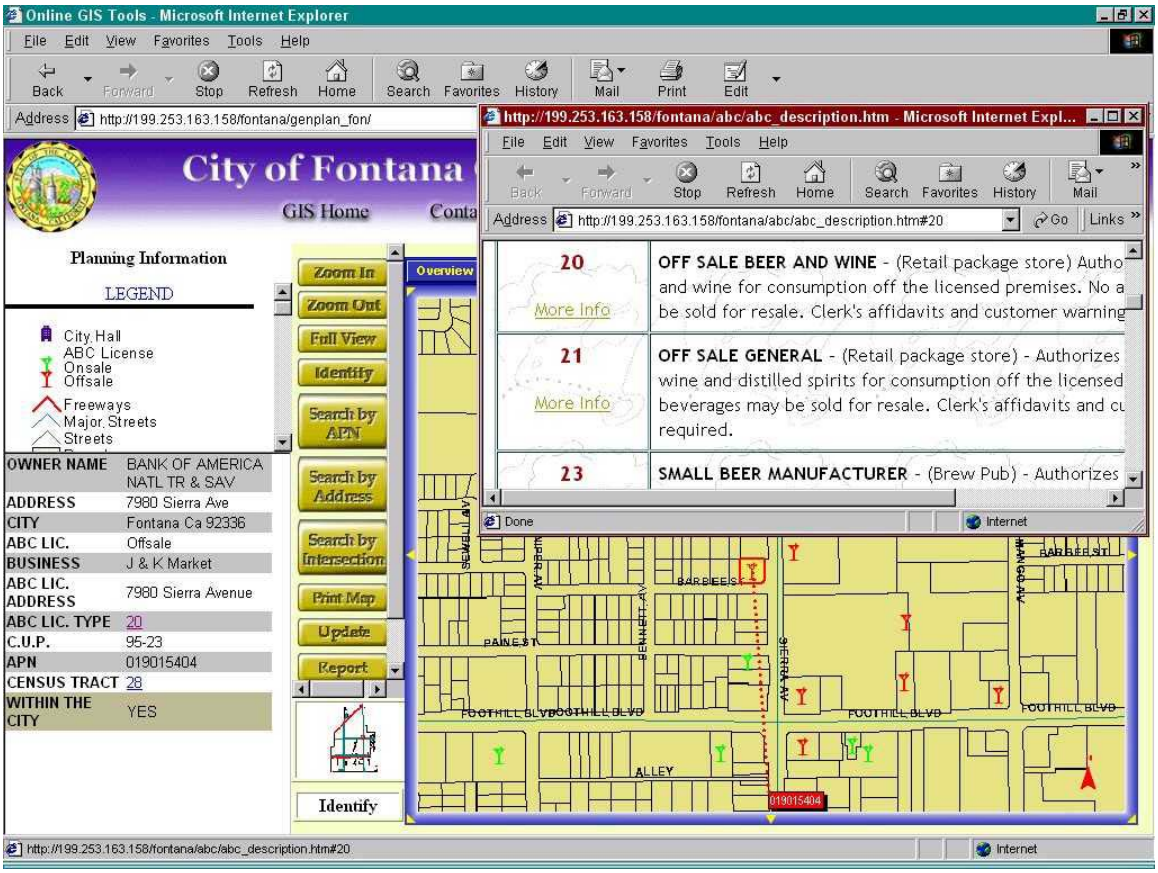
The online Planning and Zoning Information System integrates the following information components:

Property Information: Provides current parcel-specific information including ownership and valuation obtained from commercial property record data providers.

Planning Information: Provides parcel specific planning information including zoning, general plan land use, redevelopment areas, annexations, and specific plan areas.

Zoning Status Notification: When the zoning classification of a specific property is requested, a Planning specialist can query the system and generate an official letter regarding the zoning designation, attach a site map, and access the specific requirements of the zoning designation within minutes. The information package is prepared on the fly, and made available for printing. Previously, this was a manual process, which required up to several hours of work for each request.

ABC License Manager: This function is used for maintaining ABC (liquor) license information and managing license distribution throughout the city. The user can query the availability of an ABC license for specific census tracts, report on license densities, and maintain current and expired licenses on a tract-by-tract basis. The ABC license manager also provides a link to the State's Alcoholic Beverage Control Board web site for more detailed licensing information.



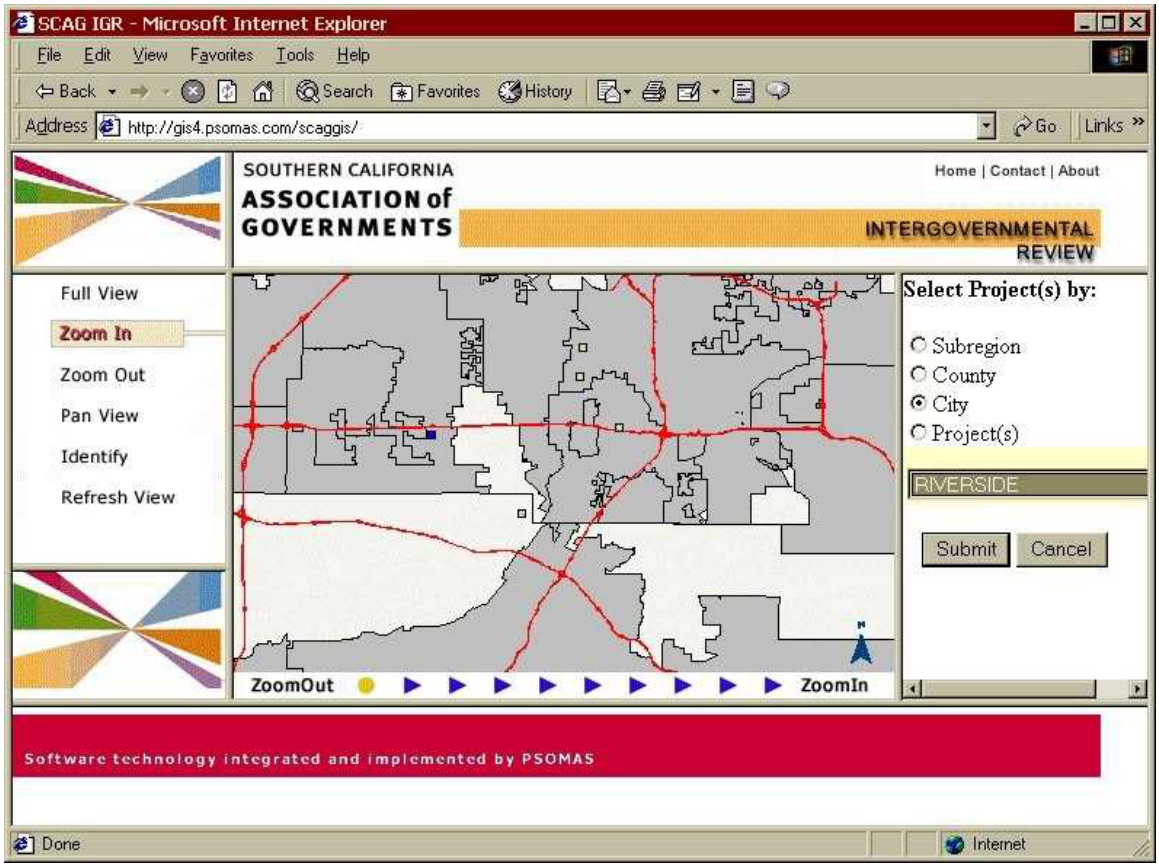
Southern California Association of Governments (SCAG)

Regional Development Tracking with Web-based GIS

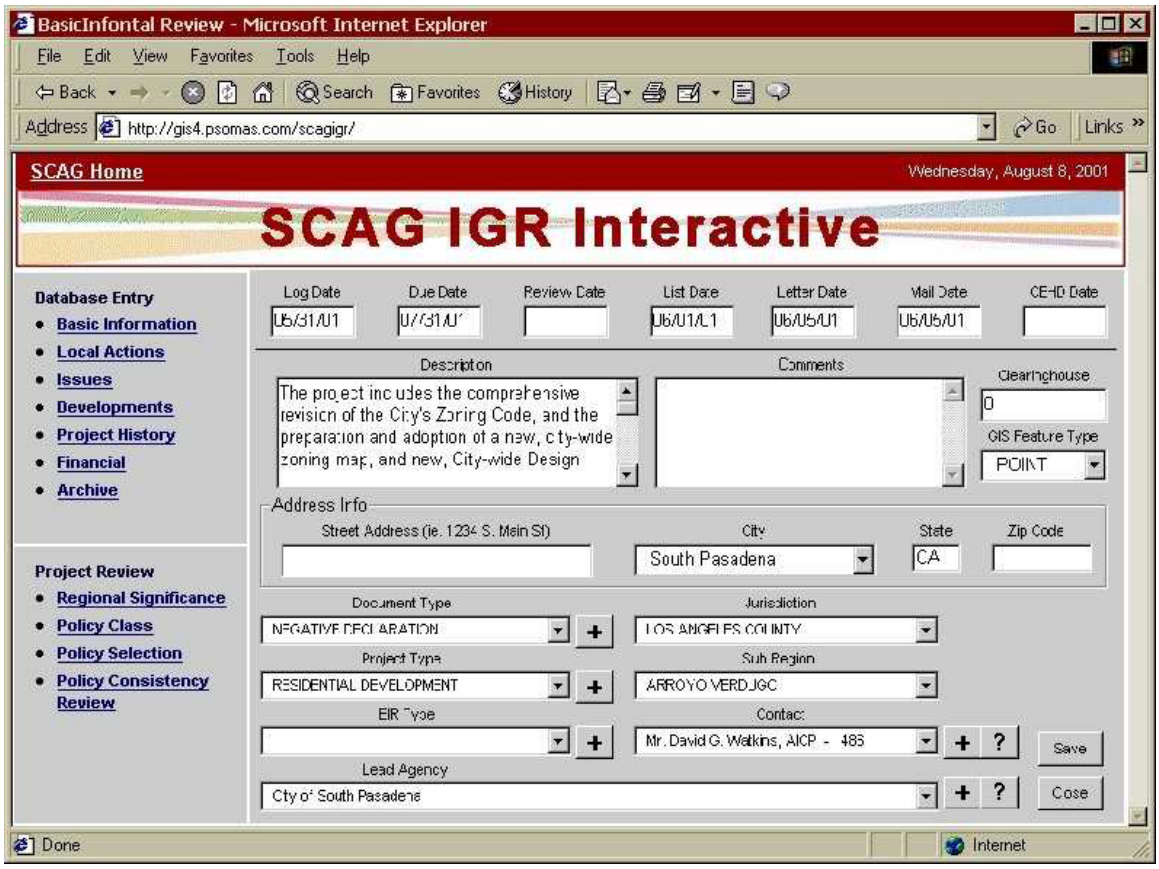
To support regional project review activities SCAG maintains an Intergovernmental Review database. SCAG receives EIRs and related documents pertaining to projects of regional significance and then reviews them for conformance to a set of regional planning policies and requirements. The goal being to ensure that growth occurs evenly throughout the region, and that major projects take all development elements into consideration at the start of the project.

The original database system used by SCAG was a proprietary database that allowed simple data input with no reporting capabilities or spatial reference. In order to improve the efficiency of the process, SCAG wanted to automate the review process to the greatest extent possible, including automated reporting, remote database access, and integration with a web-based GIS. The goal is to improve capabilities for inputting information for improved development impact analysis. The use of the web should ease the data input process, and allow for increased participation from other sub-regional agencies.

In September 1998, Psomas was selected to design and deliver a completely new IGR database and application system, which automated the entire IGR review process. This system reduces much of the redundant efforts associated with the project review process, and integrates project locations with SCAG's GIS data layers. This approach allows for a higher level of regional project impact analysis, and improved project review reporting. Additionally, the integration of GIS capabilities makes the project information available to support other planning and forecasting activities within SCAG.



The new system provides SCAG staff with a complete web-based solution for all data input, reporting and GIS integration.. The new IGR system serves as a model for all such database systems as SCAG and provide a high level of flexibility in collecting, reporting and tracking regional project related information. SCAG is currently working to migrate all similar planning and review databases to the same environment, thus supporting a much broader integration of activity and improved efficiencies in the planning, modeling and project review processes.



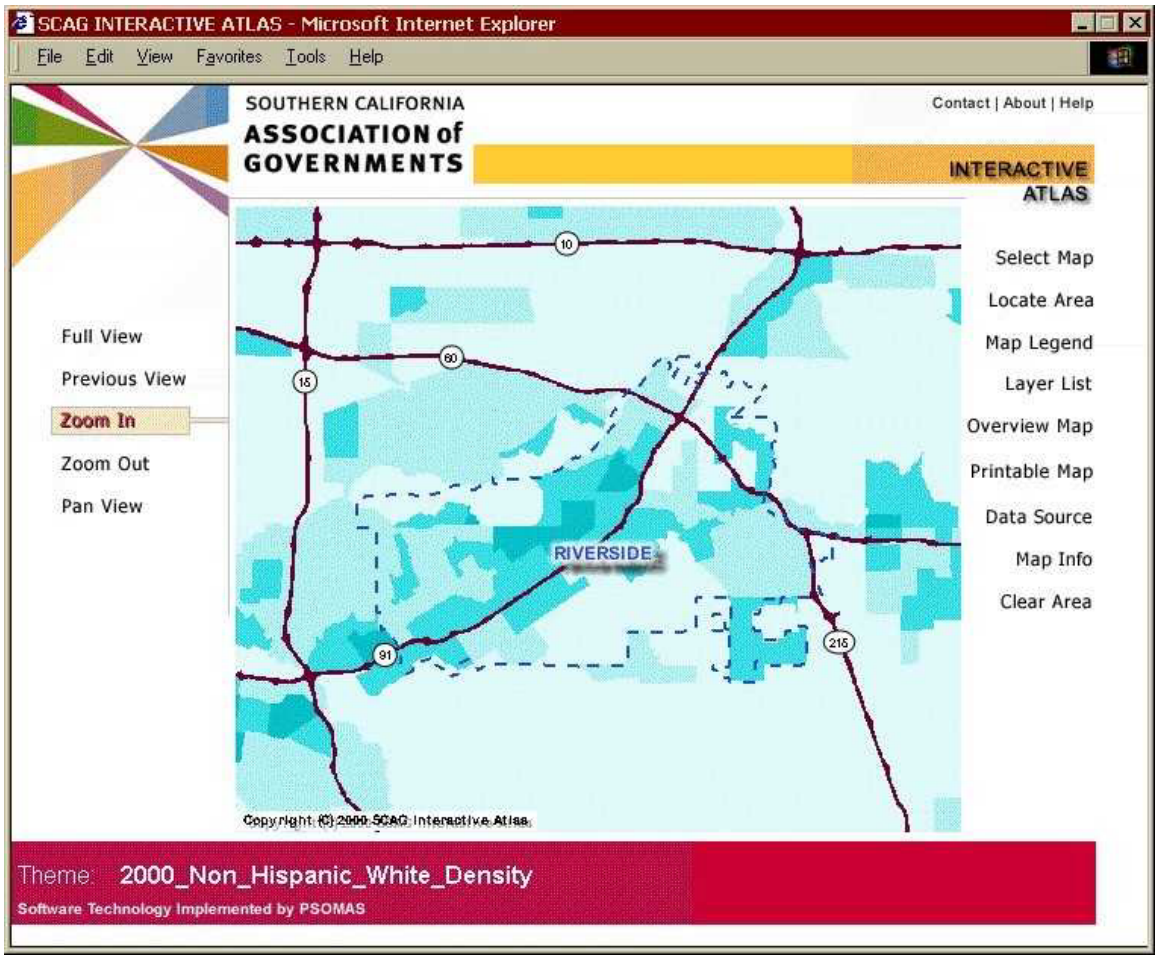
The use of the web as the primary data access interface provides broader access to the collected information to other SCAG staff and program initiatives, and eventually will be available to SCAG member agencies and the public as an information resources for planned and proposed development in the six county region.

Public data dissemination

Another step in the organization-wide usage of web-based GIS at SCAG is the development and implementation of a web-based GIS tool for providing online access to SCAG's large volumes of information of general municipal and public interest. This includes demographic information, environment data layers, regional development and transportation data; and various data layers supporting SCAG's short, medium, and long-range planning and forecasting activities. In recent years, SCAG has been increasing its

efforts to share this data with its nearly 200 member organizations. One of the objectives was to provide an online data layer and map atlas that would allow member organizations and the general public to view and query regional mapping information.

SCAG worked to develop an interactive online atlas, which places both static map representation and dynamic mapping layers online. The system allow simple queries, display of mapping information, a link to SCAG's online data catalog for ordering specific data sets, and a simple online map plotting capability. The objective was to make the content of SCAG data stores publicly available and then provide an automated mechanism for acquiring various data sets. This allows the burden of research, formatting and shipping to be removed from SCAG staff, by allowing users to either download, or order information in an online environment.



The Process of Development and Implementation of a Web-Based Solution

The process of developing and implementing a web-based solution to permitting and planning is complex. There is a considerable amount of analysis, planning, and resources required to successfully implement a web solution. This section provides the major steps for developing and implementing a web-based solution.

One of the first steps in developing a web-based solution is to identify the need for this type of solution. The request for a web-based permitting and planning solution can come from many sources. Some of these sources include your internal staff, your constituency, your governing body, or legislation from a federal governing body. The historical section above discussed that the need for a web-based solution in the Silicon Valley region was identified by the local industries who were trying to maintain their competitiveness in the extremely fast moving industry of technology.

Once you have identified the need for transacting permitting and planning over the Internet, the next step is to gather information regarding the different solutions that exist. There are three major types of solutions that should be considered. If the agency has a

large enough information technology (IT) staff, the first solution to investigate is one provided by the staff. It may be possible that agency IT staff can build the web interface to the database being used for tracking permitting and planning information. This solution will usually exist for larger agencies with large IT budgets, which can commit significant staff resources for a period of several months to the project.. The second solution is to examine the one provided by the software company that currently provides the software to manage the current permitting and planning business. A major advantage of using the vendor's web solution is that it should integrate well with the database and vendor permitting and planning software. While many of these software companies have or are testing a web solution add-on product to their current software, experience has shown that these solutions tend to be in their infancy. A major issue to consider before using a vendor supplied web solution is that the software may not be flexible enough to handle your business rules regarding transactions over the Internet. The third solution to investigate is the one that can be provided by a consultant with database and web experience. While this solution can be more expensive from a cost point of view, the local agency gets the product that meets its specific needs without allocating large amounts of staff time.

Having identified the need for a web-based solution and investigated the different options available to you, the next step in the process is to do a cost benefit analysis. The cost benefit analysis can be one of the most difficult steps in this process because analysis must be made of quantifiable and non-quantifiable benefits. Quantifiable benefits are benefits that you can easily put a dollar value on. An example of a quantifiable benefit is a reduction in the need of staff. On the other hand, a non-quantifiable benefit can be defined as a benefit that is not easily estimated such as constituency's happiness.

There are three steps to the cost benefit analysis. The first step in the analysis is to develop all of the associated costs related to implementing and using a web-based solution to planning and permitting. After estimating the cost of having a web-based solution, the next step is to estimate the benefits received from having this type of solution. The final step in the cost benefit analysis is to compare the estimated costs with the estimated benefits.

The cost of having a web-based solution for planning and permitting can come from three different sources—planning/development, implementation, and maintenance. The first set of cost stems from the planning stages of implementing a web-based solution. This cost usually occurs in the form of staff time. Initially, staff time will be used to identify the need, investigate the solutions, and doing the cost benefit analysis. The other place staff time will be used is negotiating the contracts needed with any external vendors and developing the legal requirements necessary to transact business over the web. The legal cost can easily outweigh the other costs in the planning period of the project.

The second set of costs to estimate are the ones associated with implementing a web-based solution. This set of cost is usually the most quantifiable and very easy to estimate. There are many different costs that can be associated with the implementation process. The biggest cost may come from either the development of the software by a consultant

for the web-based solution or the software package you choose from a vendor. Some of the other large costs are hardware purchases such as a new server and consulting or staff time related to installing, implementing, and testing the new web-based solution. Other costs that may arise during the implementation phase is upgrading the network, firewalls, and Internet bandwidth that will give the municipality the needed protection against hackers while providing the necessary accessibility to your constituency.

The final set of costs to estimate are the maintenance costs that will be related to upkeep and management of the web-based permitting and planning system. This cost includes the IT support staff needed to manage the new system and the maintenance fees to the vendor or the consultant to keep the system working with the database. The cost of periodic major updates of the software (i.e., major version releases) may also need to be factored in. Other sources of cost are staff training and public training on how to use the system. If you decide to use an application service provider (ASP) vendor, then there will be fees for every Internet transaction, which can add up quickly.

Once the total cost has been estimated, the next step in the cost benefit analysis is to estimate the benefits of using the Internet for planning and permitting. Estimating all the benefits can be a difficult task. This difficulty stems from the non-quantifiable benefits. As mentioned above, non-quantifiable benefits are benefits that are hard to estimate. When estimating the benefits, it is best to begin with the quantifiable benefits. The reason to start with the quantifiable benefits is because they are much easier and less subjective then the non-quantifiable benefits. The biggest quantifiable benefit is savings in future staff time. This savings comes from the shifting of the major work, data entry, to the constituency using the service and improving access to information for both staff and customers.

There are many non-quantifiable benefits to operating a web-based solution for permitting and planning. It is beyond the scope of this paper to explain ways to estimate these benefits, hence only a discussion of the different non-quantifiable benefits that should be examined will be discussed. One of the biggest non-quantifiable benefits comes in the form of being able to assist the public 24 by 7. With a web-based permitting and planning solution, the local agency has the ability to transact business outside of normal hours. This will have a positive effect on the people you transact business with. Another large benefit is that the people you transact business with will not need to make as many trips to the local agency. A third benefit is the reduction in time it takes to get a permit because many of the processes can be automated.

Once the costs and the benefits have been estimated, the only process left in the analysis is to compare the cost versus the benefits. If the costs outweigh the benefits, then the project should not move forward into implementation unless agency decision-makers can find that there are broader community objectives justifying this. If on the other hand benefits exceed cost, then the web-based solution should be implemented. It might save time to run a preliminary analysis on the cost and the quantifiable benefits first before collecting information on the non-quantifiable benefits. If the quantifiable benefits

exceed the estimated cost, then there would be little need to collect information regarding non-quantifiable benefits.

Having done the cost benefit analysis and made the decision to move forward with implementing a web-based solution, the next step is to handle all the legal work that may be related to the implementation. The first legal issue that should be dealt with is related to the legal ramifications of using the Internet. If the local agency decides to take money over the Internet, an investigation of the legal issues should be done. Other legal issues that might be encountered could come from using digital signatures should they be allowed/required by an agency. Privacy statements will need to be drafted which a qualified lawyer should do. The next legal issue, which should be fairly easily handled, is the contracts with all vendors. If a consultant is used to build a custom system, then a specification list of features and capabilities of the system should be captured in writing.

Much of what has been discussed to this point has been related to the planning stage for implementing a web-based solution. It can not be stressed enough that planning is the biggest key to success. Early in the planning stage, a project manager should be found to manage this project from start to finish. Implementing a web-based system can take months or even years to be fully implemented. Someone should be delegated to see the whole project through to keep it on budget and on time. The project manager should set-up a timeline for when things should get done and delegate who is responsible for the work. This person should hold update meetings that keep the planning and implementation team on track. The task should be clearly defined with a way of measuring success and failure.

Before releasing the new system to the public, two major tasks should be completed. First, a test should be done to the system and errors should be fixed. It is best to do this testing on a test database rather than testing on your production system. As errors and problems with the business rules arise, then fixes will need to be made or "work-around" strategies will need to be developed. A "work-around' strategy is a strategy that slightly modifies the governing business rules for the system but still allow it to work. Another task that should be completed is a full security audit of the system and the business practices. By using a system that works over the Internet, the local municipality is giving the whole world access into its production database. With the threat of hackers, it would be prudent to make sure the system is as secure as possible and to run daily backups of the programs which is a typical IT standard in any case. Also plans should be made to fix the system after attacks from hackers.

The final step in the implementation process is to release the web-based solution to the public and educate them on how to use it. One of the best ways to tell the public about the new system is by using press releases, postings on an agency web site, local government cable access channel and related resources. But telling the public is not enough. A large education campaign should be run. People will need to be educated how to use the new system and explained to the benefits of using the system.

Incorporating GIS into the Internet Component

The integration of web-based GIS follows a similar process as the development of other web-based planning and permitting systems. GIS is a technology widely used within cities and other governmental agencies throughout the world to support varied business processes. Analysis of best practices in planning, building, public safety, engineering, public works, and other areas consistently involve GIS as a flexible tool to improve information management and support decision making. Including GIS as a key component in a web-based data distribution strategy enhances the overall content and quality of information provided to the public and furthers the general understanding of the information being presented.

When considering the distribution of location-based information via the Internet, it is important to have a strategy that addresses the key goals, benefits, risks and methods. Further, it is important to understand the audience and why they would like to use the information.

As with any new system implementation it is important to clearly define the goals and objectives of the proposed solution. The goals and objectives define the desired result of the web-GIS automation effort, this will include defining the overall measure of success for the effort and key achievements for the program. Ideally, these goals should be in line, both with the overall web-strategy for the organization, as well as an enterprise GIS strategy. By aligning the web-GIS program to an overall strategy key policies, procedures and objectives can be aligned to a broader organization-wide strategy.

The next step in the process is to define and describe the justification for the system and the benefits to be derived from the proposed implementation. The purpose of defining benefits is to evaluate the benefits and establish a justification for implementing a web-based GIS component in relation to the anticipated implementation and maintenance costs. Benefits resulting from the implementation of web GIS are divided into various classes. The classes of benefits are outlined below.

> **Quantifiable Benefits -** These are measurable benefits that either directly save operating costs or generate additional revenue. These benefits can be further broken down into three benefits classes:
>
> > ***Type 1 Productivity Gains*** - Quantifiable improvement in existing practices
> > ***Type 2 New Capabilities*** - Quantifiable benefits that offer additional capabilities
> > ***Type 3 After the Fact*** - Quantifiable benefits from unpredictable events - measured after the fact
>
> **Non-quantifiable Benefits -** These are the benefits that are universally believed to be true but difficult to measure. These benefits can be further broken down into two benefits classes:

Type 4 Intangible - Benefits that produce intangible advantages
Type 5 Industry Experience - Benefit identified based on general industry experience

Once the justification and benefits of the proposed GIS implementation are established, it is necessary to identify any potential constraints and pitfalls. The evaluation of potential pitfalls and constraints to implement the web GIS components is important, because they add risk to the project and can become a major cost factor during the design and implementation of the solution. Examples of such constraints are linked to the overall environment for the planned implementation and reliance of external sources for information and support. Key areas for special attention include:

Data availability: Is an organization-wide basemap available with appropriate linked information, such as property ownership, permitting information, etc. Is accurate street and address range information and other key information layers available. Does the current format of these data sets support the desired development of a web GIS component.

Technology architecture: The technology requirements for the proposed system should be defined and a plan for integrating them into the overall enterprise architecture developed. It may be necessary to identify technology enhancement needs and include the costs into the justification process discussed above.

System Compatibility: Are the current and proposed systems compatible? Is data for the proposed web GIS in formats that can be easily integrated, or are they contained in legacy systems requiring significant effort to extract and integrate critical data.

Finally, it is necessary to know the target audience for the web application. If it is designated for staff within the organization only a different set of data access and usage policies will be required. Further, privacy considerations, will also limit the volume and content of information made available to the public via the Internet.

Lessons Learned from the Smart Permit Initiative

There were many lessons learned from the Smart Permit Initiative and trying to implement a web-based solution onto the Internet as well as the implementation of web-based GIS solution for other planning agencies. One of the greatest lessons learned is that implementing a web-based system can be very time consuming for staff. When possible, the use of consultants to alleviate some of the workload can be extremely helpful. Another option is to lighten the workload of key staff so they can help with the planning and implementation. Early on the benefits the staff will receive should be emphasized. Some staff may be reluctant to change.

Another major lesson learned when trying to implement a web-based solution is that during the implementation phase every aspect of the web-base system needs to be tested

thoroughly. Since every software application will have bugs, the main point to thoroughly testing is to discover those bugs and either get them fixed or develop "work-around" strategies. Usually these "work-around" strategies will require the local agency to modify their business rules to accommodate for some of the bugs that exist.

Since testing everything is so important, time and resources should be allocated to it. Experience with the Smart Permit Initiative has shown that testing can be very difficult to do by general staff. There are many long and tedious hours that are involved in the testing process. Usually the local agency neither has the time or the experience to thoroughly test the system completely and methodically. When time is short, testing time tends to get cut.

A third major lesson is that throughout the process of planning and implementation, everything should be documented. Keeping good records of all the issues discovered will ensure that nothing gets overlooked. One of the issues discovered during this whole process is that there are times when vendors are not as responsive as you expect them to be.

Summary and Future Predictions

Developing and implementing a web-based solution to planning and permitting can be very beneficial to both the local agency and their constituency. Over a period of six plus years (1995-2001) processes were improved, technology was developed and then deployed and the Silicon Valley region collaborated to roll out a number of permit applications on the Internet. Standard forms were posted online for most of the participants in the Smart Permit Initiative. San Carlos and Santa Clara provided information about permits available online. San Carlos is also utilizing the web for comment on public hearing items. Milpitas, Mountain View, Sunnyvale, and San Jose all have simple permits online. These experiences have taught many lessons which were shared in this paper. This paper provided an overview of the process to develop and implement a web-based system for permitting and planning. It also explained how Planning agencies can integrate and utilize GIS on the Internet.

From the experience gained from going through the Smart Permit Initiative, there are many predictions that can be made for web-based permit and planning. Rapid developments in technology and the changing nature of government will lead communities to imagine and create new levels of smart permitting. Based on their experience, participants in the region on the Smart Permit effort offer these predictions many of which have broader implications for web-based GIS/Planning services as well:

- Standards for digital signature technology will emerge and its use will be pervasive.
- The use of emerging tools such as Internet collaboration software and 3-D modeling will become mainstream in the permit and development review process.
- Access to the permit system via wireless devices such as cell phones, laptop computers, and handheld computers will become routine.

- Online plan submission and plan checking tools will mature and become easier to use.
- Building codes, zoning regulations and other permit-related rules and guidelines will be available electronically and linked to the permit systems.
- Online plan checking and redlining will be similar in approach to today's grammar checking in text documents.
- "White boarding," or the use of online collaboration tools will become prevalent.
- Document management technology will become ubiquitous and organizations will move closer to paperless operations.
- Use of Application Service Providers (ASPs) to host government systems will increase in smaller agencies to address the difficulty of retaining IT staff and to lower the cost of ownership of technology.
- Planning will become less of an art and more of a science through the use of interactive planning tools.
- Smart permitting will be integrated into the supply chain.
- Adoption of regional GIS standards will support real-time access to planning and development activities in surrounding communities.
- Disparate information sources will be integrated to create a cohesive planning and community development tool.
- Smart permitting workflow will be integrated into the overall development process

Several larger trends will shape the future of smart permitting, GIS and related Planning Agency efforts. These trends include online access, enterprise information systems, electronic government, and regionalism.

In addition to widespread Internet access in the workplace, people now have access from home, school, libraries, and other community centers. As cities shift to online information and services, they will need to work with community groups and service providers to make sure that everyone has affordable online access and that these services are reliably provided outside of typical office hours.

The growing trend in private industry to integrate disparate systems into a single, cohesive, enterprise information management system will eventually reach local government. Local government's approach to technology is typically a department-by-department solution for each business function such as permitting vs. parks and rec programs. In the future, smart permitting will be just one module of an integrated enterprise system using emerging technologies.

Electronic government leverages Internet access and enterprise information management systems to offer access to services. A "Virtual City Hall" working 24 by 7 overcomes the constraints of traditional office hours and systems. Permit status checking and online comments on proposed development projects were first steps for the permit process. Imagine the ability to view detailed GIS maps, 3-D models of a community, proposed

development projects, and surrounding areas. This access will dramatically affect how local Planning agencies provide information and interact with the community.

Bibliography and Resource links

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Various working reports from Joint Venture Silicon Valley

Joint Venture: Silicon Valley web site (includes links to all the Smart Permit pilot cities): http://www.jointventure.org/initiatives/smartpermit/pilot.html

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